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Important role of mandibular organ in molting, growth, and survival of mud crab*Scylla olivacea*

Akbar Marzuki Tahya[1], Muhammad Zairin Jr[1]*, Arief Boediono[2] I Made Artika[3], and Muhammad Agus Suprayudi[1].

[1]Department of Aquaculture, Bogor Agricultural University, Indonesia
[2]Department of Anatomy, Physiology, Pharmacology, Bogor Agricultural University, Indonesia
[3]Department of Biochemistry, Bogor Agricultural University, Indonesia

Abstract : Molting is a long process in crustaceans, it is substantially associated to the growth, reproduction, and survival. The physiological of molting is essentially linked to the hormonal control. Henceforth a clear knowledge about molting process and hormonal control are important. Mandibular organ (MO) is one of many organs thats play role in molting and reproduction. The influence of exogenous MO in the progress of molt, growth, and mortality in commercial mud crab was investigated. Injection of MO into intermolt crabs increased molting percentages, molting simultaneity, growth acceleration, and adaptability. The results confirm that the MO is involved in the control of molting in *Scylla olivacea*. Nonetheless, further research is required to study the role of exogenous MO in the adaptability of crabs.
Keywords. Adaptability; Crab; Growth; Injection; Mandibular Organ; Molting.

Introduction

The regulation of molting in insects and crustacean can be accelerated by multy-factors. The presence of endogenous hormone is one of the internal factors, which can initiate premolt. Premolt is one of molting phases. This phase is crucial caused of conciseness in energy preparation to face ecdysis. Molting is physiological-complexity that required many mechanisms. Mandibular Organ (MO) is one of many organs thats play role in molting[(1;2)]. MO firstly described as another pair of crustacean glands by LeRoux[(3)]. Formerly, MO and Y-organ were hard to discern because the similarity both in histology and anatomy. Since MO is known as Methyl Farnesoate (MF) producing-organ, now biochemically can be distinguish from Y-organ[(4)]. In aquaculture, molting acceleration and simultaneous are required because most of the reared crabs are incapable to do that. In the present study, we investigated the role of MO in molting progress of commercial crab *S. olivacea*.

Material and Method

Male crabs *Scylla olivacea* were obtained from fisherman in South Sulawesi Province, Indonesia. Healthy crabs and ± 100 gram of body weight (BW) were selected as test crabs. The crabs were maintained individual in crab box and fed fresh fish 10% of crab's body weight per day. The crabs were divided into 2 groups, control (A) and injected of MO (I).

Result and Discussion

Molting

The injection of mandibular organ increased the molting percentage and was found to have an effect on simultaneity of molting. The present study showed that the injected crabs had higher percentage of molting than control test crabs (Figure 1).

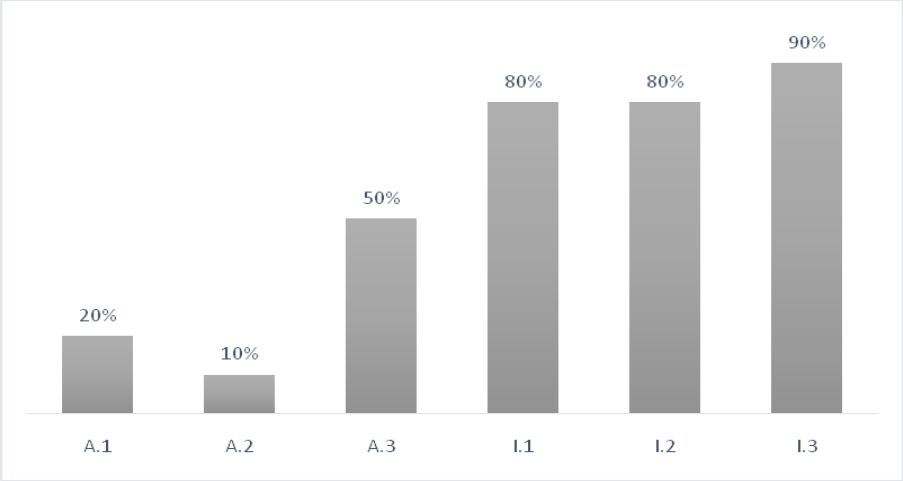

Figure 1. Molting percentages of control (A) and injected crabs (I)

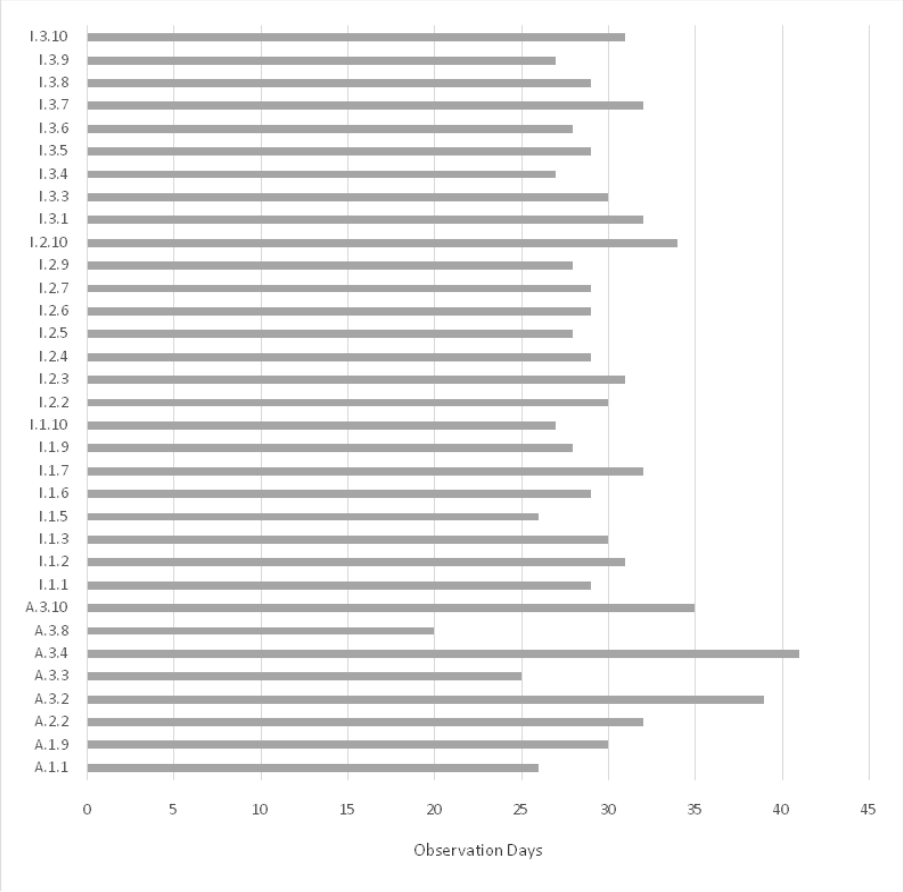

Figure 2. The time required for molting of test crabs

The results showed that the injected of MO had higher molting percentage i.e. 80, 80, and 90%, than control crabs i.e. 20, 10, and 50%. The results presented in Figure 1 also show that the percentage values of injected crabs are more consistent than control crabs. The role of MO has been observed in several crustaceans, such as *Oziotelphusa senex senex*[4;5], *Procambarus clarkii*[6], *Charybdis lucifera*[7]. The results confirm that the molting is under the positive regulation of MO. Therefore, suggested that MF of MO play an important role for stimulation of Y-organ. When stimulation through MO extraction are administrated, the ecdysteroid level increases and releases in haemolymph stream that may be responsible for simultaneous molting (Figure 2).

In control crabs the time required for molting between 20 to 41 days to reach of 26.67%, while in injected required shorter time i.e 26 to 34 days to reach the percentage of 83.33%. In soft shell crab farming, rapidity and simultaneity of molting is expected in order that the production process can be achieved early and efficient of maintenance. The present study showed that control crabs were faster molting then injected. While the injected of MO more simultaneous of molting. The longer time in the control treatment was reasonable due unavailability trigger of ecdysteroid to be secreted out from the Y organ. Unlike the injection treatment of MO which has MF as a trigger. As MF administration resulting response of molting in *Cherax quadricarinatus*[8], male and female of *O. senex senex*[5]. Injection of MO was effectifely stimulated ecdysteroid which resulted in simultaneity of molting. If it follows the normal rules without stimulation, the release of MF from MO will be affected by control of X Organ Sinus Gland (XOSG). The Mandibular Organ Inhibiting Hormone (MOIH) from XOSG will be influence to molting of crab, because the role of MOIH is negatively control MO to secrete and release of MF to hemolymph, as the result that molting will be postpone. Molting process also will be delay, when Molting Inhibiting Hormones (MIH)s from XOSG are widely circulated in hemolymph.

Growth

In Figure 3, data on the body weight (BW) and the carapace width (CW) of crabs are reported. As shown, the CW increased with increasing BW in both postmolt growth and non-molt growth. Based on this study, the BW increased on an average by 30.13 g and CW increased on an average by 10.58 mm in postmolt growth of control, and BW increased on an average by 31.88 g and CW increased on average by 12.24 mm in postmolt growth of injected. While in non-molt growth, the BW increased on an average by 7.77 g and CW increased on an average 3.91 mm in control, and BW increased on an average by 9.25 g and CW increased on an average 3.98 mm in injected.

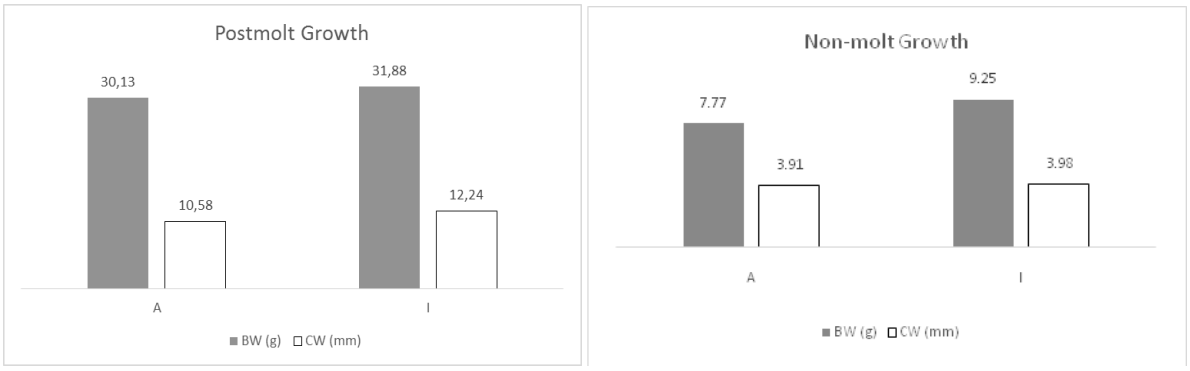

Figure 3. Success molting (postmolt) and non-molt growth of testing crabs.

During 45 days observation, BW and CW increased both in control and injection. But BW and CW of crabs increased significantly in postmolt growth. The administration of MO may stimulates the source of molting hormone, resulting in increased ecdysteroid level and internal body growth. In fresh water crab *O. Senex senex*, the administration of MF has been reported to stimulate testis growth[5]. Weight difference that occurs can not be separated from the role of MF and ecdysteroid, such as in protein synthesis[9], and molting[4;8]. However, at the end of the observation we found some test crabs were unsuccessfully molting, but the data of BW and CW were taken. Based on data, it needs to be pointed out that the growth also occured although in non-molting crabs, but growth of non-molt crabs increased with a low percentage. The significant growth in postmolt and lack of growth in non-molt crabs are affected by multy factors. Kleinholz [10] reviewed that molting in crustaceans is affected by extrinsic factors i.e. temperature, salinity of medium, light intensity,

pollutants, and by intrinsic factors i.e. nutritional, and hormones. Based on swim legs observation, the control crabs groups were also in intermolt stage after the completion of experiment (Figure 4.A). All of the non-molt crabs, which received the MO injection entered in to premolt stage (Figure 4.I). These observation ilustrate the role of MO on molting progress in mud crabs *S. olivacea*. Much evidence shows that MF in MO play a positive role in the control of molting and growth, but relatively few data have been provided relating the physiological role of MF.

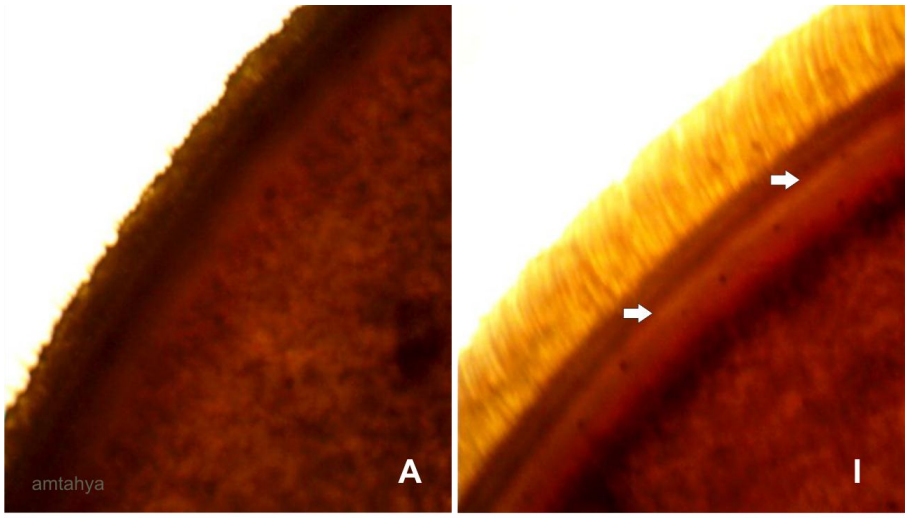

Figure 4. Swim legs observation of control (A) and injection (I), non-molt crabs, the arrow indicated retraction

Mortality

The mortality during the observation occured in control crabs. Figure 5, indicates that the mortalities of crabs only occured in control, and all of injected survived for 45 days observation. The control crabs in A1, A2, and A3 died by 30, 20, and 20%, respectively. It is interesting to note that mortality consistently occured in the control crabs. This may be caused by the stresses of cultivation environment, and then mortality started on day 2 to 31. The present study showed that the injected crabs more adaptable to environmental stress and acclimation. It needs to be pointed out that molting failure syndrome can be also be occured by the fit and proper of health. So it can be assumed that the test crabs were in a healthy and ready for molting. Lovett *et al.*[11; 12; 13] found an increase of MF in *Carcinus maenas* exposed to environmental stress. Further research is needed to study the MF of MO in the adaptability of crabs.

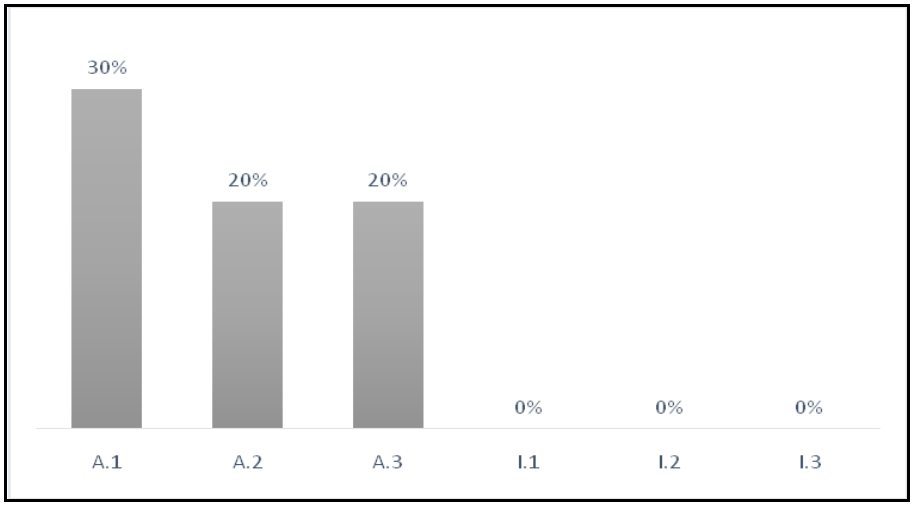

Figure 5. Mortality percentages during observation.

Conclusion

The results of this study indicated that the role of MO in molting progress, molting simultaneity, growth acceleration, and adaptability of commercial mud crabs *Scylla olivacea*. These results provide strong evidence that MF play an important role in physiology of molting.

Acknowledgements

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